



LOUISIANA STATE UNIVERSITY
AND AGRICULTURAL AND MECHANICAL COLLEGE
Department of Computer Science

(3)

AD-A254 961



September 11, 1992

Defense Technical Information Center
Building 5, Cameroon Station
Alexandria, Virginia 22304-6145



Dear Sir:

Enclosed are 3 copies of our annual report (1991-1992) on our Grant No. N00014-91-J-1306 titled "A General Theory of Signal Integration for Fault-Tolerant Dynamic Distributed Sensor Networks".

If you need more information please do not hesitate to contact me.

Sincerely yours,

A handwritten signature in black ink, appearing to read "S. S. Iyengar".

S.S. Iyengar
Professor and Chairman
Principal Investigator

SSI:jbc/ltr3

Approved by
Listed under Item 10

OFFICE OF NAVAL RESEARCH
PUBLICATION/PATENTS/PRESENTATION/HONORS REPORT
1 OCT 1991 THROUGH 30 SEPT 1992

R&T Number:

Contract/Grant Number: ONR Grant No: N00014-91-J-1306

Contract/Grant Title: A General Theory of Signal Integration for Fault-Tolerant Dynamic Distributed Sensor Networks

Principal Investigator: S.S. Iyengar and B. Jones

Mailing Address: Dept. of Computer Science, Louisiana State University, Baton Rouge, LA 70803-4020

Phone Number: (with area code) 504-388-1495

E-Mail Address: iyengar@bitnet.cs.csc.lsu.edu

- a. Number of Papers Submitted to Refereed Journal but not yet published: 4
- b. Number of Papers Published in Refereed Journals: 5
(list attached) (and accepted)
- c. Number of Books or Chapters Submitted but not yet Published: 6
- d. Number of Books or Chapters Published: _____
(list attached)
- e. Number of Printed Technical Reports & Non-Referred Papers: 2
(list attached)
- f. Number of Patents Filed: N/A
- g. Number of Patents Granted: N/A
(list attached)
- h. Number of Invited Presentations at Workshops or Prof. Society Meetings: 3
- i. Number of Presentations at Workshops or Prof. Society Meetings: 2
- j. Honors/Awards/Prizes for Contract/Grant Employees:
(list attached, this might include Scientific Soc. Awards/Offices, Promotions, Faculty Awards/Offices etc.)
- k. Total number of Graduate Students and Post-Docs Supported at least 25% this year on this contract/grant:

Grad Students 2 1/2 and Post-Docs _____.

[Grad Student Female _____]

How many of each are females or minorities? [Grad Student Minority _____]

(These 6 numbers are for ONR's EEO/Minority [

Reports; minorities include Blacks, Aleuts [Grad Stu Asian e/n 2]

Am Indians, etc and those of Hispanic or [

Asian extraction/nationality. The Asians [Post-Doc Female _____]

are singled out to facilitate meeting the [

varying report semantics re "under-represented"). [Post-Doc Minority _____]

[Post-Doc Asian en/ _____]

SECOND YEAR PROJECT REPORT

ONR GRANT NO : N00014-91-J-1306

TITLE OF THE PROJECT

A General Theory of Signal Integration for Fault-Tolerant
Dynamic Distributed Sensor Networks

Professor S.S. Iyengar
Professor B.J. Jones

October 1, 1992

DTIC QUALITY INSPECTED 3

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Statement of the problem:

The computational issues related to information integration in multisensor systems and distributed sensor networks has become an active area of research. In recent years a number of significant advances in the field of sensor integration have been made. This interest in the development of Distributed Sensor Networks (DSNs) for information gathering has partly emerged because of a) the availability of new technology which makes the DSNs economically feasible to implement and b) the increasing complexity of today's information gathering tasks to which they are applied.

From a computational viewpoint, the efficient extraction of information from noisy and faulty signals emanating from many sensors requires the solution of problems related to a) the architecture and fault-tolerance of the distributed sensor network, b) the proper synchronization of sensor signals, c) the integration of information to keep the communication and the processing requirements small, and d) the design of efficient computational techniques to abstractly represent and integrate sensor information.

The following issues were studied and worked upon this year:

- 1) Computational frameworks for distributed sensing and fault-tolerant sensor integration.
- 2) Design of fault-tolerant architectures for distributed sensor integration.
- 3) Computational complexities of the problem of distributed detection.
- 4) Wavelet based distributed sensing and fault-tolerant sensor integration.
- 5) Issues related to recording of events and synchronization in distributed sensor networks.

Attatched to this report is a list of publications resulting from this research.

RESEARCH PUBLICATIONS

List of papers accepted/published in refereed journals:

- 1) S. S. Iyengar, M. B. Sharma and R. L. Kashyap "Information Routing and Reliability Issues in Distributed Sensor Networks," IEEE Trans. on Signal Processing, September 1992.
- 2) Raj Narayan, S. S. Iyengar, R. Sridhar, and R. L. Kashyap "An Optimal Distributed Algorithm for Recognizing Mesh-Connected Networks," Journal of Theoretical Computer Science, Vol. 119, November 1992.
- 3) L. Prasad and S. S. Iyengar "An asymptotic equality for the number of necklaces in a shuffle-exchange network," Theoretical Computer Science, Vol. 102, pp. 355-365, 1992.
- 4) S. S. Iyengar, D. N. Jayasimha and D. Nadig "A Versatile Architecture for the Distributed Sensor Integration Problem," To appear in IEEE Trans. on Computers.
- 5) S. V. N. Rao, S. S. Iyengar and R. L. Kashyap "Computational Complexity of the Distributed Detection Problem," To appear in Journal of Computers and Elec. Engg.

Paper under revision:

- 6) L. Prasad and S. S. Iyengar "A General Computational Framework for Distributed Sensing and Fault-Tolerant Sensor Integration," International Journal of Robotics Research, MIT Press. Revised paper submitted to editors at Oxford University. Also, Technical Report , Department of Computer Science, LSU.

List of papers submitted to refereed journals:

- 1) V. G. Hegde and S. S. Iyengar "An Efficient Distributed Algorithm to find Biconnected Components of an Asynchronous Network," Submitted for publication to Information Processing Letters. Also, Technical Report TR-92-015, Dept. of Computer Science, LSU.
- 2) S. S. Iyengar and D. Nadig "Using Temporal Intervals for Synchronization in Real Time Distributed Systems," Submitted to Electronic Encyclopedia.
- 3) V. G. Hegde and S. S. Iyengar "Efficient Distributed Planarity Testing Algorithms in the context of DSN," Submitted for publication.
- 4) B. Jones and S. S. Iyengar "Root Isolation for Non Linear Equations," Submitted for publication to International Journal of Systems Theory.

List of papers in refereed conference proceedings:

- 1) B. Jones and S. S. Iyengar "Information Theoretic Contributions of Components in Distributed Sensor Networks," Proceedings of the thirty sixth annual meeting, International Society for the System Sciences, Denver, Colorado, July 12-17, 1992.
- 2) L. Prasad and S. S. Iyengar "A General Computational Framework for Distributed Sensing and Fault-Tolerant Sensor Integration," Proceedings of the IEEE Southcon Conference, March 1992.

Invited Talk:

Indo-US Workshop in Computer Science, August 4 - 6, 1992, Bangalore, India.

Research papers in progress:

- 1) Wavelet Based Distributed Sensing and Fault-Tolerant Sensor Integration.
- 2) Scaling and Temporal Characterization of Sensor Integration Problem in Distributed Environments. This is an extension of Dr. Madan's work on Maximum Entropy techniques.